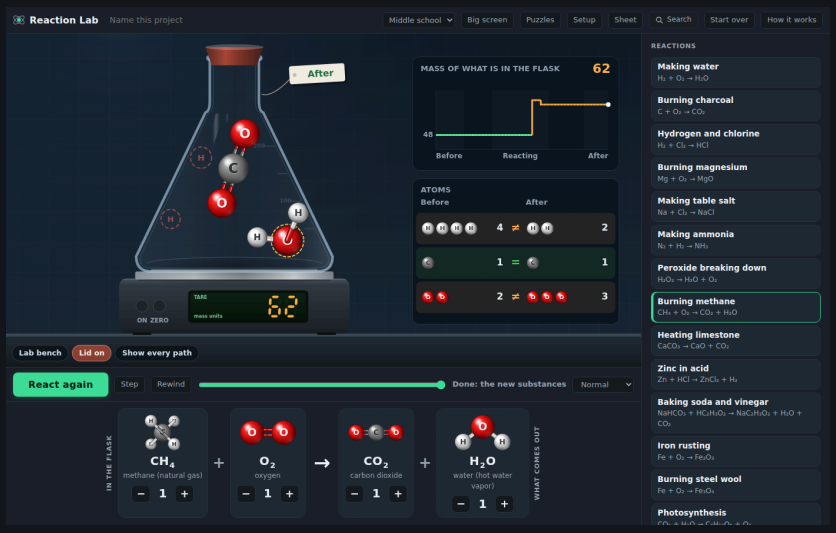
mytekDev

Reaction Lab: The Equation That Lies

Grades 6-8 · 45 minutes

Physical science · Chemistry



Slides, rubric and answer key | Print and go | No student accounts | Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a claims table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school chemistry
- Standards: NGSS

Reaction Lab: The Equation That Lies

Grades 6-8 · 45 minutes · Physical science, Chemistry

An unbalanced equation is a claim that atoms were made or destroyed. Students run burning methane unbalanced on purpose and read what it claims, balance it with whole molecules, then work three puzzles: the missing molecule, the picture that cannot be right, and an equation with the same total of atoms on each side that is still not balanced.

At a glance

ESSENTIAL QUESTION

What is an unbalanced equation really saying about atoms?

OBJECTIVES

Students will be able to:

- say what an unbalanced equation claims: atoms made or destroyed
- balance an equation with whole molecules until each kind of atom matches
- tell a balanced equation from one where only the total number of atoms matches
- choose the missing product that lets every atom have a place

VOCABULARY

Balanced equation, Coefficient, Subscript, Claim, Law of conservation of mass

STANDARDS

MS-PS1-5

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/reactionlab?lesson=the-equation-that-lies&ref=tpt-reactionlab-2 once on a student computer: it opens on Burning methane, unbalanced, with one of each molecule. Run it as it opens and read the guide on the right, then open Puzzles and try Same total, wrong atoms, about five minutes.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up about the eggs and the cakes.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open: Burning methane, one of each. Press React. Read the guide on the right aloud: which atoms vanished or appeared. Show What this equation claims, then Two numbers, two jobs. Press the small 2 in H_2O on the board and show the card. > **It's working when:** Ask the class to predict the scale before the first React. Most expect it to hold, because they have been told mass is conserved. The surprise is the lesson.	Watch, and fill in the vocabulary on the worksheet.
12 to 22	**Guided practice (We do)** Methane together	Students open the link or scan the QR code. A short guide walks them through: React unbalanced, read the claim, balance it, React again, open Puzzles. Check that every scale reads 80 before and after. > **Watch for:** Students who add molecules on one side only. The Atoms card shows which rows still say ≠.	Fill in the first rows of the claims table: the unbalanced run, what it claimed, and the balanced equation.
22 to 38	**Independent practice (You do)** Puzzles	Students work the three middle school puzzles. Walk the room with the What to look for questions. > **If they ask:** "Each side has four atoms. Why is that not enough?" Same total	Work The missing molecule, Which picture is right? and Same total, wrong atoms, and write each answer and its reason in the table.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students explain why the ammonia equation is not balanced. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/reactionlab?lesson=the-equation-that-lies&ref=tpt-reactionlab-2. A short guide opens over the app on Burning methane with one of each molecule: $CH_4 + O_2 \rightarrow CO_2 + H_2O$, not balanced.

1. **Run it unbalanced.** Press `React`. The atoms with no place fade out with a red ring, atoms needed from nowhere pop in with an amber ring, and the scale and the graph step. The guide on the right names it: which atoms vanished, which appeared.
2. **Balance it.** The answer is $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$. React again and the scale holds at 80.

3. **Puzzles.** The top bar opens five: Fix the claim, The missing molecule, Which picture is right?, Same total, wrong atoms, and at high school The odd oxygen. Each choice says why it is right or wrong.

> The puzzle that lands is Same total, wrong atoms: four atoms on each side and still not balanced. It catches the student who has learned to count atoms but not each kind.

Background for the teacher

An equation is a statement about atoms. If it is not balanced, it says some atoms appeared or disappeared, which never happens in a chemical reaction. The app plays that claim literally: the atoms with nowhere to go fade out and the scale drops, or atoms appear from nothing and it rises. In a real flask the extra molecules would simply be left over; the app says so at the high school level.

Balancing means choosing how many whole molecules of each substance there are. The coefficients change; the subscripts never do, because they are part of what the substance is. The smallest whole numbers are the usual answer, but any multiple is also balanced.

Common mistakes: matching the total number of atoms instead of each kind; changing a subscript; and balancing one element while unbalancing another.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- What did your unbalanced equation claim happened to the atoms?
- Which number did you change to balance it, and which one did you leave alone?
- Each side has four atoms. Why is that not enough?
- Why is the picture with three water molecules wrong?
- Is 4 H_2 + 2 O_2 → 4 H_2O balanced? Is it the smallest answer?

> The third question is the real test: the answer has to name each kind of atom.

Cross-curricular extensions

- Math: a balanced equation is a set of ratios. If 2 H_2 makes 2 H_2O, how much water does 10 H_2 make?
- English: write the unbalanced methane equation as a false news headline, then correct it.
- Computer science: describe the steps you use to check an equation is balanced, as a recipe a computer could follow.
- History: chemists in the 1700s weighed sealed vessels to prove that mass is conserved. Find out who and how.

Vocabulary

Balanced equation	An equation with the same number of each kind of atom on both sides.
Coefficient	The big number in front of a formula: how many molecules there are.
Subscript	The small number in a formula. It is part of the substance and never changes when you balance.
Claim	Something an equation says happened. An unbalanced one claims atoms appeared or vanished.
Law of conservation of mass	Mass is not made or destroyed in a chemical reaction.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the atoms on the board as you say each word: the letters on the balls carry the meaning.
- Pair each learner with a partner for the puzzles; each choice has a picture or a formula.
- Accept the claims table as the ≠ rows circled, without sentences.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for methane, one reading the Atoms card and one pressing the buttons.
- Zoom the browser to 150%.
- Allow two puzzles instead of three where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "This equation claims ___ atoms vanished."
- A check-in after methane: every scale reads 80 before anyone opens Puzzles.
- Do Same total, wrong atoms together on the board.

STUDENTS READY FOR MORE

- Switch to high school in the level menu and solve The odd oxygen.
- Write an unbalanced equation for photosynthesis and say exactly what it claims before balancing it.
- Find a reaction on the shelf that is already balanced as written, and say how you checked.

Adapting for other grades

Younger students: In grades 4 and 5, run water unbalanced and balanced together, then do only The missing molecule; total 8 on the first two rubric rows, and 6 meets the objectives.

Older students: In high school chemistry, pick high school in the level menu: students type the numbers, add the masses in atomic mass units, and solve The odd oxygen, which needs every number doubled.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/reactionlab?lesson=the-equation-that-lies

Essential question: What is an unbalanced equation really saying about atoms?

Warm-up: A recipe says 2 eggs make 1 cake. Someone writes "2 eggs make 3 cakes." What is wrong?

_____

1. **Vocabulary.** Balanced equation, coefficient, subscript, claim, law of conservation of mass: write each in your own words.

2. **The claims table.** Unbalanced: $CH_4 + O_2 \rightarrow CO_2 + H_2O$. It claimed these atoms vanished _____ and these appeared _____. The scale went from ____ to ____. Balanced: ____ CH_4 + ____ O_2 → ____ CO_2 + ____ H_2O.

3. **Puzzles.** The missing molecule: _____ because _____. Which picture is right: _____ because _____. Same total, wrong atoms: _____ because _____.

1. Why can you not balance an equation by changing H_2O to H_2O_2?

2. $N_2 + H_2 \rightarrow NH_3$ has four atoms on each side. Is it balanced? Explain with each kind of atom.

Reaction Lab: The Equation That Lies

Exit ticket

Name: _____

1. Which equation is balanced? (A) $H_2 + O_2 \rightarrow H_2O$ (B) $2\ H_2 + O_2 \rightarrow 2\ H_2O$ (C) $H_2 + O_2 \rightarrow H_2O_2$ written to make it balance

2. When you balance an equation, you may change: (A) the small numbers in a formula (B) the number of whole molecules (C) both

3. An unbalanced equation is run in a sealed flask on a scale. What would the scale show, and why can that not happen in a real reaction?

Reaction Lab: The Equation That Lies

Exit ticket

Name: _____

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2. When you balance an equation, you may change: (A) the small numbers in a formula (B) the number of whole molecules (C) both

3. An unbalanced equation is run in a sealed flask on a scale. What would the scale show, and why can that not happen in a real reaction?

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	4 hydrogen and 2 oxygen atoms on each side. C changes the substance to hydrogen peroxide.
2	B	The small numbers are part of the substance.
3	The mass would change	The equation claims atoms were made or destroyed. Real atoms are not, so a real sealed flask keeps its mass. The change named with its reason is a full answer.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The claim	Names exactly which atoms vanished or appeared in the unbalanced run, and that the scale moved because of it.	Names the atoms that vanished or appeared.	Says it was wrong without saying how.	No claim recorded.
Balancing	Methane balanced with whole molecules in lowest whole numbers, written as an equation.	Methane balanced.	Balanced on one kind of atom only.	Not balanced, or a formula changed.
The puzzles	All three solved with a reason that names each kind of atom.	All three solved.	One or two solved.	None solved.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for MS-PS1-5: the model shows that only a balanced equation keeps the atoms, and so the mass, the same.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-PS1-5**	6-8	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	Students use the model to compare what a balanced and an unbalanced equation say about the atoms and the mass.

Checked November 2026 against: NGSS MS-PS1-5, Matter and its Interactions.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/reaction-lab/lessons/the-equation-that-lies/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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